

## DESCRIPTION

### MOVABLE FENCE AND OPENING/CLOSING METHOD FOR MOVABLE FENCE

#### TECHNICAL FIELD

[0001]

The present invention relates to a movable fence provided on a platform for a track vehicle such as a railroad train to prevent a passenger from falling to a railroad track or contacting with a train and further to facilitate the monitoring of passengers on the platform, and an opening/closing method for the movable fence.

#### BACKGROUND ART

[0002]

Conventionally, on a platform for a track vehicle, a platform door has often been provided as a movable fence to prevent passengers from falling onto a railroad track or coming into contact with a train. Usually, a plurality of platform doors are provided along the end edge portion on the railroad track side of the platform, and a door body is opened or closed by sliding through one opening of a door pocket fixed on the top surface of the platform.

For example, for the platform door 83 described in Japanese Patent No. 3306055, which is shown in Figure 24, a pair of door pockets 82a and 82b are provided adjacently, and a set of door pockets 82a and 82b is provided in plural numbers at intervals in the extension direction of platform. In the door pockets 82a and 82b, door bodies 81a and 81b are provided, respectively, so as to be capable of advancing and retreating in the facing direction (right-and-left direction on paper), and are opened or closed by sliding.

The opening/closing portion of these door bodies 81a and 81b is arranged in front of a car door, and the door bodies 81a and 81b are opened or closed in association with the opening/closing of the car door.

[0003]

In such a platform door 83, between the paired adjacent door pockets, a distance from the left end of the door pocket 82a to the right end of the door pocket 82b is an opening portion (boarding-alighting port) "L" for passengers to get on and off the car. According to the above-described construction of the platform door 83, one door body 81a, 81b is provided in one door pocket 82a, 82b, and one opening is provided in each of the door pockets 82a and 82b. The construction is such that the door body 81a, 81b slides through on opening of the door pocket 82a, 82b, and when the door body 81a, 81b is opened, is stored in the door pocket 82a, 82b.

[0004]

For the platform door 83, a supporting device and a driving device for the door body 81a, 81b are provided in the door pocket 82a, 82b. For this reason, the length of the door pocket 82a, 82b is longer than the length in the slide direction of the door body 81a, 81b. Therefore, on a platform 80, the door pockets 82a, 82b each having a large size stand in a row in the transverse direction (lengthwise direction of the railroad track). In some cases, a train having a different door position or door number arrives at the platform 80 provided with the platform door 83 because of different composition or model of cars, mutual use of each other's tracks by two or more railroad companies, and the like. In such a case, the boarding-alighting port of car is inconsistent with the position of the opening portion "W" of the door body 81a, 81b of the platform door 83, so that the platform door 83 hinders passengers from getting on and off the car.

[0005]

As another conventional art, a platform door disclosed in Japanese Patent Provisional Publication No. 2002-308089 is shown in Figures 25 and 26. This platform door is contrived so that the length of a door pocket 90 is decreased, and the projection length of door from the door pocket is increased relatively.

Specifically, linear rails 93 and 94 for a left-hand side door body 97 and a right-hand side door body 98 are provided on the side surface of the interior of the door pocket 90 at an interval so as to overlap with each other vertically. On the upper and lower linear rails 93 and 94, two slide blocks 95 provided movably along the linear rails 93 and 94 are fitted. The slide blocks 95 are provided at the rear of the left and right door bodies 97 and 98, and are supported on a support member 100 arranged so as to overlap with the other door body at an interval horizontally. Pulleys 99 are fixed turnably on the side surface of the door pocket 90. One pulley 99 is connected to a drive motor 101, and a belt 103 set around the paired pulleys 99 and the support member 100 are connected to each other by a belt gripper 105. According to this conventional art, the length (R) of door body can be increased by a portion in which the support members 100 of the left and right door bodies 97 and 98 overlap with each other. Conversely, when the length of the door body is the same, the length of the door pocket can be decreased. Patent Document 1: Japanese Patent No. 3306055 (refer to abstract and Figure 1)  
Patent Document 2: Japanese Patent Provisional Publication No. 2002-308089 (refer to Abstract and Figures 1 and 3)

## DISCLOSURE OF THE INVENTION

Problems That the Invention is to Solve

[0006]

However, for the platform door shown in Figures 25 and 26, since the

construction is such that the support members 100 are supported by being deformed horizontally, a considerable amount of gap (Z) is required between the two, so that the length (R) of the stored door body 97, 98 is restricted with respect to the total length (Y) of the door pocket 90. That is to say, the length (R) of the stored door body 97, 98 cannot exceed the value of  $((\text{total length (Y) of door pocket 90} - \text{gap (Z)}) \times 0.5)$ . For this reason, this platform door cannot sufficiently respond to a recent car having various door positions, presenting the same problem as that of the platform door shown in Figure 23.

[0007]

In view of the above circumstances, an object of the present invention is to provide a movable fence of a platform door, in which a door pocket having openings on both sides and a door body longer than the door pocket are provided, and the opening/closing of door body is controlled independently so that the stroke is variable, by which the boarding-alighting port for a car having a different door position is made consistent with the open portion of the platform door so that passengers can get on and off the car safely and smoothly, and an opening/closing method for the movable fence.

Means of Solving the Problems

[0008]

To solve the above problems, the present invention provides a movable fence including a door pocket provided on a platform so as to face to a car arriving at the platform; and a door body advancing and retreating through an opening of the door pocket, characterized in that the opening for advancing and retreating the door body is formed at both ends of the door pocket in the advance/retreat direction of the door body; the length in the advance/retreat direction of the door body is made longer than the length of the door pocket between the both ends; and the door body is opened so as to

correspond to a boarding-alighting port of the car.

Although the movable fence may be arranged so that the door body is opened and closed manually, the opening and closing of the door body may be controlled by a control unit according to information about arrangement of boarding-alighting ports of the car arriving at the platform.

The movable fence may be arranged so that an indicator capable of providing arbitrary display or non-display is provided along the advance/retreat direction of the door body, and the display of the indicator is provided so as to correspond to the open position of the door body.

The door body of the movable fence may be formed into a lattice shape by providing support members at intervals in the longitudinal and transverse directions of the door body. Also, a roll curtain or an accordion curtain may be mounted on the door body, and further an outside plate may be mounted on the door body.

The movable fence may be arranged so that at least the platform side of the door pocket is covered with the door body.

The movable fence may be arranged so that a pair of door bodies are disposed in the door pocket, and the length in the advance/retreat direction of the door body is made longer than the length of the door pocket between the both ends.

The movable fence can be arranged so that a fixed fence is provided on the platform between the door body and a door body adjacent to the door body.

The movable fence can be arranged so that the advance and retreat of the door body are carried out by a combination of toothed pulleys and a toothed belt, a combination of a chain and sprockets, a combination of a rack and a pinion, a hydraulic actuator, or a pneumatic actuator.

The movable fence is arranged so that the door pockets are arranged at right

angles to the direction in which the car arrives at the platform.

The movable fence can be arranged so that the door pockets are arranged in a zigzag form along the direction in which the car arrives at the platform.

In addition, to solve the above problems, the present invention provides a movable fence including a door body which advances and retreats to the outside and inside through the opening of a door pocket, characterized in that the opening for advancing and retreating the door body is formed at both ends of the door pocket in the advance/retreat direction of the door body; the length in the advance/retreat direction of the door body is made longer than the length of the door pocket between the both ends; and a gateway is opened and closed or the opening is adjusted by the movement of the door body.

The present invention provides an opening/closing method for a movable fence, which uses a door pocket provided on a platform so as to face to a car arriving at the platform; a door body advancing and retreating through the opening of the door pocket; and a control unit incorporating data formed into a pattern for each car based on door position information inherent in the car, including the steps of sending a pattern of door position information of the car to a platform in a wireless mode; receiving the pattern of door position information of the car arriving at the platform by a platform side; identifying door positions of the car arriving at the platform by selecting the pattern of door position information inherent in the car; determining the slide amount of the door body in connection with the pattern of door position information of the car; and opening the door body according to the slide amount of the door body.

With the above-described opening/closing method for a movable fence, the pattern of door position information of the car can be sent to the platform by a transmitter of the car arriving at the platform.

With the above-described opening/closing method for a movable fence, regarding

a step of forming a pattern of the door position information of the car, when train car composition is changed, the door position information pattern of the changed train car composition can be sent to the platform in a wireless mode.

With the above-described opening/closing method for a movable fence, the step of opening the door body according to the slide amount of the door body can enable the door body to advance and retreat through the openings at both ends of the door pocket of the door body.

With the above-described opening/closing method for a movable fence, the step of opening the door body according to the slide amount of the door body can enable one door body to advance and retreat while projecting from the openings at both ends of the door pocket of the door body.

Effects of the Invention

[0009]

As an effect of the movable fence in accordance with the present invention, since in the movable fence including the door pocket provided on the platform so as to face to a car arriving at the platform; and the door body advancing and retreating through the opening of the door pocket, the opening for advancing and retreating the door body is formed at both ends of the door pocket in the advance/retreat direction of the door body; the length in the advance/retreat direction of the door body is made longer than the length of the door pocket between the both ends; and the door body is opened so as to correspond to the boarding-alighting port of the car, the width of door pocket can be made narrow, and inversely the width of door body can be made wide. Since the width of door pocket can be made narrow, arrangement corresponding to the number and position of the boarding-alighting ports of different trains can be adopted. This configuration naturally has the inherent advantages of a movable fence of preventing

passengers from falling onto a railroad track, preventing passengers from coming into contact with a train, and further facilitating the monitoring of passengers on the platform.

If the opening and closing of a door body are controlled by the control unit according to the information about the arrangement of boarding-alighting ports of the car arriving at the platform, the movable fence can alleviate the burden of a station employee at the platform.

Also, since the movable fence is arranged so that an indicator capable of providing a display optionally in an on-state or an off-state is provided along the advance/retreat direction of the door body, and the display of the indicator is provided so as to correspond to the open position of the door body, passengers are guided to the indicator in response to the train having different boarding-alighting ports and a different number of boarding-alighting ports, whereby the boarding and alighting of passengers are made smooth.

Since the door body is provided with support members at intervals in the longitudinal and transverse directions, the door body can be formed at a low cost.

The shield of the movable fence can be made complete by mounting a roll curtain or an accordion curtain on the door body, or by mounting an outside plate on the door body.

As another effect of the movable fence in accordance with the present invention, since in the movable fence including a door body which advances and retreats to the outside and inside through the opening of a door pocket, the opening for advancing and retreating the door body is formed at both ends of the door pocket in the advance/retreat direction of the door body; the length in the advance/retreat direction of the door body is made longer than the length of the door pocket between the both ends; and the gateway is opened and closed or the opening is adjusted by the movement of the door body, the



boarding and alighting of passengers can be made smooth and the opening of the door body can be adjusted according to the number of passengers, for example, in the case where the movable fence is provided at the gateway of a facility.

## BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

Figure 1 is a front view of a platform door in accordance with the present invention;

Figure 2 is a sectional view taken along the line A-A of Figure 1;

Figure 3 is a sectional view taken along the line B-B of Figure 1;

Figure 4 is a sectional view taken along the line C-C of Figure 1;

Figure 5 is an enlarged front view of a cam follower portion of a guiding device shown in Figure 1, viewed from the front of the guiding device;

Figure 6 is an enlarged sectional view of a cam follower portion taken along the line D-D of Figure 5, viewed from the side of a guiding device;

Figure 7 is an enlarged front view of a driving device of a guiding device shown in Figure 1, viewed from the front of the guiding device;

Figure 8 is an enlarged sectional view of a driving device taken along the line E-E of Figure 7, viewed from the side of a guiding device;

Figure 9 is an enlarged front view of a supporting device for supporting a door body of the platform door shown in Figure 1, viewed from the front of a guiding device;

Figure 10 is an enlarged sectional view of a supporting device taken along the line F-F of Figure 9, viewed from the side of a guiding device;

Figure 11 is a front view showing an example (second embodiment) of a door body of the platform door shown in Figure 1, showing a state in which a shield curtain is

disposed on the door body;

Figure 12 is a sectional view taken along the line G-G of Figure 11;

Figure 13 is a front view showing an example (third embodiment) of a door body of the platform door shown in Figure 1, showing a state in which an accordion curtain is disposed on the door body;

Figure 14 is a sectional view taken along the line H-H of Figure 13;

Figure 15 is a front view showing an example (fourth embodiment) of a door body of the platform door shown in Figure 1, showing a state in which a door pocket is divided into two pieces and the door body is provided in each of the divided door pockets, and a plate is disposed on the door body;

Figure 16 is a sectional view taken along the line J-J of Figure 15;

Figure 17 is a front view showing an example (fifth embodiment) of a door body of the platform door shown in Figure 1, showing a state in which an outside plate is disposed on the door body;

Figure 18 is a sectional view taken along the line K-K of Figure 17;

Figure 19 is a sectional view taken along the line L-L of Figure 17;

Figure 20(a) is a ~~plan~~ plane view showing a door body position in a train waiting state in which a train does not arrive at a platform in the embodiments of the present invention, Figure 20(b) is a plane view showing a door body position in a state in which a four-door car is stopping at a platform, Figure 20(c) is a plane view showing a door body position in a state in which a three-door car is stopping at a platform, and Figure 20(d) is a plane view showing a door body position in a state in which a two-door car is stopping at a platform;

Figure 21 is a control system diagram showing an example for controlling the opening/closing of a door body in the embodiments of the present invention;

Figure 22 is a chart showing one example of patterns for each composition of cars in the embodiments of the present invention;

Figure 23 is a schematic flowchart for identifying a pattern for each composition of cars in the embodiments of the present invention;

Figure 24 is a front view of conventional door pockets and door bodies used on a platform;

Figure 25 is a front view showing a conventional construction of a door pocket and door bodies used on a platform; and

Figure 26 is a sectional view of the door pocket and door bodies shown in Figure 25, viewed from the plane direction.

#### Description of Symbols

[0011]

1 ... platform door

3 ... end edge portion

5 ... door pocket

7a, 7b ... door body

9 ... pillar

11 ... outside plate

12 ... frame

13 ... side plate

15 ... guiding device

17 ... driving device

18 ... fastening element

19 ... supporting device

- 20 ... frame
- 21 ... control unit
- 23 ... vertical member
- 24 ... horizontal member
- 25 ... cam follower
- 27 ... toothed belt
- 29 ... guide roller
- 31 ... toothed pulley
- 33 ... speed reducer
- 35 ... drive motor
- 37 ... linear rail
- 39 ... linear guide
- 41 ... frame
- 43 ... outside plate
- 44 ... intermediate support member
- 45 ... vertical plate
- 51 ... train
- 52 ... boarding-alighting port
- 53 ... indicator
- 58a, 58b ... shield door
- 61 ... roll curtain
- 62 ... curtain
- 63 ... fastener
- 65 ... accordion curtain
- 67 ... plate

80 ... platform

## BEST MODE FOR CARRYING OUT THE INVENTION

[0012]

Embodiments of a movable fence in accordance with the present invention will now be described with reference to the accompanying drawings.

Figure 1 is a front view of a platform door used as a movable fence in accordance with the present invention, Figure 2 is a sectional view taken along the line A-A of Figure 1, Figure 3 is a sectional view taken along the line B-B of Figure 1, and Figure 4 is a sectional view taken along the line C-C of Figure 1. In this description, front and rear mean the direction crossing the lengthwise direction of a platform 80, described later, namely, the train traveling direction, front being the platform 80 side, and rear being the railroad track side, and right and left mean the lengthwise direction of the platform 80, namely, the train running direction.

A platform door 1 is disposed along an end edge portion 3 on the railroad track side of the platform 80, and is supported by a door pocket 5 erected on the platform 80. The door pocket 5 has pillars 9 erected at four corners, outside plates 11 arranged at the front and rear of the pillars 9, and side plates 13 arranged at the right and left thereof.

In the door pocket 5, a pair of door bodies 7a and 7b are provided with an appropriate clearance being provided in the front and rear direction. The door bodies 7a and 7b can be slid in the lengthwise direction of the platform 80. The right and left side plates 13 provided on the door pocket 5 are provided with an opening 5a portions for allowing the door bodies 7a and 7b to slide therethrough. In Figure 1, the outside plate 11 on the front side of the door pocket 5 is omitted for ease of understanding of the construction in the door pocket 5.

[0013]

The door body 7a, 7b is constructed so that vertical members 23 are provided in a substantially vertical direction at both sides in the width direction thereof, a plurality of horizontal members 24a to 24d (sometimes, referred simply to as horizontal members 24 as a whole) are arranged in a substantially horizontal direction with suitable clearances being provided vertically, and both of the vertical members 23 and the horizontal members 24 are fixed to each other. These members 23 and 24 are formed of an aluminum alloy, steel, synthetic resin, or the like.

Further, reinforcing members are preferably provided between the vertical members 23 and between the horizontal members 24 with appropriate clearances being provided. The cross-sectional shapes of the horizontal members 24 are as shown in Figure 4. Specifically, the horizontal member 24a has a U shape, 24b has an I shape, 24c has a square shape, and 24d has a rectangular shape. These shapes may be selected properly according to the application and location.

[0014]

In order to move the door bodies 7a and 7b, the door pocket 5 incorporates a guiding device 15, a driving device 17, a supporting device 19, a control unit 21 for driving and controlling these devices, and the like.

Figure 5 is an enlarged front view of a cam follower 25 portion of the guiding device 15 shown in Figure 1, viewed from the front of the guiding device 15, and Figure 16 is a sectional view of the cam follower 25 portion taken along the line D-D of Figure 5.

As shown in Figure 5, the guiding device 15 is disposed under the horizontal members 24a located at the uppermost position of the four horizontal members 24 disposed above and below. The guiding device 15 is provided with a pair of cam followers 25. The paired cam followers 25 are provided on a frame 12 fixed on the

pillars 9 in the door pocket 5 in series at an appropriate interval in the direction in which the door bodies 7a and 7b slide, and as shown in Figure 6, are provided in parallel so as to correspond to the door bodies 7a and 7b at the rear and front. Each of the cam followers 25 fits in the horizontal member 24a formed into a channel shape in cross section so that the horizontal member 24a slides. In Figure 6, the cam follower 25 is disposed in the horizontal member 24a of a channel shape having an opening in the lower surface. However, the arrangement may be such that the horizontal member 24a is formed of a pipe and is disposed so that the peripheral surface thereof is held by the cam follower 25. Further, a device formed by turning over the later-described supporting device 19 may preferably be provided.

[0015]

Figures 7 and 8 show the driving device 17 for the platform door 1. The driving device 17 is provided at the lower end of the horizontal member 24b, which is fixed between the vertical members 23 of the door body 7a, 7b and is located at the second position from the upside. The driving device 17 has a toothed belt 27, two guide rollers 29, and a toothed pulley 31 arranged between the guide rollers 29.

One end of the toothed belt 27 is fixed to the left vertical member 23 by a fastening element 18, and the other end thereof passes through the guide roller 29 and meshes with the toothed pulley 31, passing again through the guide roller 29, and is fixed to the right vertical member 23 by a fastening element 18. The guide rollers 29 are rotatably attached, via a bearing, to a vertical plate 45 installed to a frame 20 fixed between the pillars 9. The toothed pulley 31 is connected to the output shaft of a speed reducer 33 attached to the vertical plate 45.

[0016]

Further, the speed reducer 33 is connected to a drive motor 35 so that the toothed

pulley 31 is turned in the normal and reverse directions by the normal and reverse rotation of the drive motor 35, and thereby the door body 7a, 7b is slid to the right and left. Although the horizontal member 24b is shown by an I-shaped member, it may preferably have a shape such as to wrap the toothed belt 27 to protect the same (for example, a channel shape whose lower surface is open). Also, although the drive motor 35 connected with the speed reducer is used as a driving source, a directly-coupled motor or a hydraulic or pneumatic actuator may be used. As a driving system, a combination of a rack and a pinion or a combination of a chain and sprockets may be used. Further, in the case where a somewhat long door pocket like the later-described platform door 1a, 1b, 1e, 1f shown in Figure 20(a) can be provided, a drive using a belt and pulleys as shown in Figure 23 may be available. In this case, as in the conventional example shown in Figure 23, pulleys 99 are disposed near both ends of the door pocket.

[0017]

Figures 9 and 10 show the details of the supporting device 19 of the door body 7a, 7b. As shown in the figures, in the door pocket 5, linear guides 39 are fixed to a frame 41 attached between the pillars 9, the linear guides 39 being provided in the lengthwise direction of the horizontal member 24c located at the third position from the upside with a suitable clearance being provided therebetween. On the other hand, on the lower surface of the horizontal member 24c fixed to the vertical members 23, a linear rail 37 extending over an appropriate length in the lengthwise direction is fixed by a suitable means such as welding. The linear guide 39 having a cross section of a U shape is formed with a convex portion 39a therein, and the linear rail 37 is formed with a concave portion 37a corresponding to the convex portion 39a, so that the linear rail 37 engages with the linear guide 39. In Figures 9 and 10, the supporting device 19 using a combination of the linear rail 37 and the linear guide 39 is shown. However, the



horizontal member may be supported by being held by cam followers, rollers, or bushes disposed above and below.

[0018]

Second to fifth embodiments of a movable fence in accordance with the present invention will be explained with reference to Figures 11 to 19. The door body 7a, 7b in the above-described embodiment is made up of the vertical members 23 and the horizontal members 24. Therefore, the door body 7a, 7b has a lattice shape in appearance and has spaces. In the second to fifth embodiments, a shield door in which the spaces are filled is explained below. The same symbols are applied to the same elements, and the detailed explanation thereof is omitted.

Figures 11 and 12 show a movable fence in accordance with the second embodiment of the present invention. As the door body 7a, 7b of this platform door 1, a shield door using a roll curtain is shown.

For the door body 7a, 7b, roll curtains 61 are fixed on the side plates 13 provided on both right and left sides of the door pocket 5 so as to be pulled out in the transverse direction. Therefore, two roll curtains 61 are provided for each of the door bodies 7a and 7b, and the tip end of a curtain 62 is attached to the vertical member 23 of the door body 7a, 7b by a fastener 63.

When a shield door 58a, 58b is slid to the right or left, one curtain 62 is pulled out with a fixed tension being kept, and the other curtain 62 is rolled up in the roll curtain 61. The door body 7a, 7b is in a state in which a portion pulled out of the door pocket 5 is always covered with the curtain 62.

[0019]

Figures 13 and 14 show a movable fence in accordance with the third embodiment of the present invention.

As the door body 7a, 7b of this platform door 1, a shield door using an accordion curtain is shown. In the figures, the shield door 58a, 58b on which both ends of an accordion curtain 65 is fixed is provided between the side plate 13 on both sides of the door pocket 5 and the right and left vertical members 23 of the door body 7a, 7b. The accordion curtain 65 expands and contracts according to the slide to the right and left of the shield door 58a, 58b. When the door body 7a, 7b is slid, the accordion curtain 65 on one side expands, and the accordion curtain 65 on the other side contracts and is folded. In a portion of the door body 7a, 7b pulled out of the door pocket 5, the accordion curtain 65 always covers the whole surface of the door body 7a, 7b.

[0020]

Figures 15 and 16 show a movable fence in accordance with the fourth embodiment of the present invention.

For this platform door 1, two door pockets 5 are provided in parallel at the front and rear, and one door pocket 5 is arranged independently for each of the door bodies 7a and 7b. A U-shaped plate 67 is attached to the vertical members 23 located at the right and left of the door body 7a, 7b so as to cover a rear-side half of the door pocket 5. Thereby, when the door body 7a, 7b advances or retreats, the pulling-in in the opening portion is eliminated. In the case where the door pockets are provided independently in this manner, the positions of the door pockets may be shifted. In this case, three or more door pockets 5 may be arranged in a zigzag form at equal intervals (or unequal intervals). Also, although the plate 67 is provided so as to cover a rear-side half of the door pocket 5 in this embodiment, the plate 67 may be provided so as to cover the whole of the door pocket 5. As the plate 67, a metallic plate, a resin-made plate, or the like can be used.

[0021]

Figures 17 to 19 show a movable fence in accordance with the fifth embodiment

of the present invention.

The platform door 1 in accordance with this embodiment shows a shield door in which an outside plate 43 is added to the front surface side of the door body 7a, 7b shown in Figure 1. In the figures, the shield door 58a, 58b to which the outside plate 43 is affixed is provided between the right and left vertical members 23 of the door body 7a, 7b. In this case, as shown in Figure 19, an intermediate support member 44 for installing the guiding device 15, the driving device 17, and the supporting device 19 is provided.

Thus, by the shield door 58a, 58b shown as the second to fifth embodiments of the present invention, the whole surface of the door body 7a, 7b facing to passengers waiting on the platform 80 is shielded, which improves the appearance, the reliability, and a sense of security.

By clearly showing the position and width of the opening portion of platform door by using an indicator 53, passengers waiting on the platform will not become confused, thereby improving a sense of security and a sense of trust.

[0022]

Figures 20(a) to 20(d) show one example of platform to which the present invention is applied.

As shown in the figures, the boarding-alighting port of a car having different door positions and the open portion of the platform door can be made consistent with each other. Therefore, it is preferable that a device for giving the passengers information about the locations of the doors of a train arriving next be provided.

As shown in Figure 20(a), the indicators 53 provided with light emitters are provided on the floor surface of the platform door opening portion. The indicators 53 consist of divided tiles, and include embedded light emitting members, being arranged so

as to indicate the opening amount of platform door. Alternatively, the arrangement may be such that the indicator 53 is provided on one straight line along the platform without being divided, and only portions corresponding to the car doors are light-emitted (indicated). Also, although the indicator 53 is provided on the floor surface in this embodiment, the indicator may be provided above the open portion of the door body. The control of lighting range of the indicator 53 is carried out, as described later, in association with the door opening/closing amount control (stroke control) performed by manual input in addition to wireless information from the train or the control unit using the data such as train composition and train timetable incorporated in advance. The control unit for this purpose is provided in a platform door body or a separately provided control panel.

[0023]

The platform door 1 of the above-described embodiments can be applied to all doors 1 arranged on the platform. However, in the case where the somewhat long door pockets 5 like the door pockets 5 of platform doors 1a, 1b, 1e and 1f can be provided, platform doors of a conventional type are provided in these portions, and the platform doors in accordance with the present invention may be provided at positions of the remaining platform doors 1b and 1c. This proposal can offer the advantage that on the platform on which the platform door has already been provided, repair work for accommodating trains having different door positions can be performed easily by partially providing the platform door in accordance with the present invention in an intermediate portion or an end portion of the platform.

[0024]

As shown in Figures 20(a) to 20(d), according to the platform door 1 in accordance with the present invention, the door bodies 7a and 7b are disposed at an

appropriate interval in the horizontal direction in the door pocket 5, and the right and left side plates 13 of the door pocket 5 each have an opening portion. For this reason, the door body 7a, 7b can be slid independently to the right and left. Therefore, the door pocket 5 has only to have a minimum width necessary for housing the guiding device 15, the driving device 17, the supporting device 19, and the like, and inversely, the length of the door body 7a, 7b can be increased to an arbitrary length.

[0025]

As the result, the length of the door body 7a, 7b can be increased with respect to the length of the door pocket 5. Also, both of the front and rear door bodies 7a and 7b can be slid to one side, or can be slid to the right or left by an arbitrary stroke.

Also, the door body 7a, 7b, which is formed of a rod-shaped material formed into a pipe, H shape, square pipe, channel shape, is very light in weight, has high visibility, and does not give a sense of oppression. Further, the door pocket 5 is short in length and light in weight, so that the installation work at the site can be performed easily in a short period of time. Even the installation of the platform door 1 on the existing platform 80 does not hinder the running of trains.

As explained above, the platform door 1 in accordance with the present invention has a flexible arrangement, so that it can be used for trains having various kinds of door positions.

[0026]

Next, a door opening/closing system for opening and closing the platform door 1 will be explained.

Figure 21 shows the door opening/closing system of the platform door in accordance with the present invention. This system mainly includes an operation direction center 70, a station monitor panel 71, and an integrated control panel 72.

These pieces of equipment can send and receive signals mutually or indirectly. Specifically, the integrated control panel 72 can send and receive signals bidirectionally to and from the station monitoring panel 71 and a ground-side transmitter receiver 74, and the operation direction center 70 can send and receive signals bidirectionally to and from the station monitor panel 71. The operation direction center 70, which is provided at all stations, is aware of the composition, model, position, etc. of trains on the railroad track. Also, the train is provided with a train-side transmitter receiver 73, which can send and receive signals bidirectionally in a wireless mode to and from the ground-side transmitter receiver 74 disposed on the platform side.

The ground-side transmitter receiver 74 is connected bidirectionally to the station monitor panel 71 via the integrated control panel 72. The operation direction center 70 sends the train information of a train arriving next at a specified station to the station monitor panel 71. The train information includes the already-described train inherent number, and the train information about the train arriving next is displayed on the station monitor panel 71. That train information is displayed on the integrated control panel 72 at the same time.

[0027]

For example, from the operation direction center 70 at an adjacent station T located on the down side from a station S, train information 76a about a train that left the adjacent station T and is running toward the station S is sent to the station monitor panel 71 at the station S. The integrated control panel 72 at the station S having received the train information 76a sends a collective opening/closing signal 76b to all of individual control panels 75a to 75d and so on (denoted by a symbol 75 as a whole) based on the train information 76a.

The integrated control panel 72 includes the collective opening/closing signal 76b

corresponding to the plurality of door bodies 7a, 7b to be opened of all of the door bodies 7a, 7b based on the train inherent number included in the train information 76a. The individual control panel 75 selectively receives an opening operation signal 78 by means of the collective opening/closing signal 76b. Then, the indicators 53a to 53d and so on (denoted by a symbol 53 as a whole) corresponding to the door bodies 7a, 7b to which the opening operation signal 78 is output go on before the arrival of train. The passengers who intend to get on that train wait before the door bodies 7a, 7b positionally corresponding to the lighted indicators 53.

[0028]

When the train arriving at that station stops at a predetermined position, the train driver or the conductor turns on an operation switch of the train-side transmitter receiver 73. The ON state value is sent from the train-side transmitter receiver 73 to the ground-side transmitter receiver 74 as a wireless signal. The ground-side transmitter receiver 74 sends a door body operation start signal 76c to the integrated control panel 72 based on the ON state value. The integrated control panel 72 sends the collective opening/closing signal 76b corresponding to the train inherent number included in the train information 76a with the receipt of the door body operation start signal 76c being an AND condition.

[0029]

The opening operation signal 78 is a collective signal for selectively and optionally opening the plurality of the door bodies 7 in accordance with the collective opening/closing signal 76b. The opening operation signal 78 is received selectively by the individual control panel 75 via a bus line, and the individual control panel 75 sends an individual opening/closing signal 79a corresponding to the opening operation signal 78 to the control unit 21 (refer to Figure 1) for the door bodies 7a, 7b.

Based on the individual opening/closing signal 79a, the door bodies 7a, 7b

responding to the individual opening/closing signal 79a are opened. Based on this opening operation, the indicators 53 lighting corresponding to the door bodies 7 go off. The indicators 53 may be lighted after the door bodies 7 have been closed.

[0030]

The integrated control panel 72 having received the door body operation start signal 76c sends a confirmation signal 76d for confirming that the door body operation start signal 76c has been received to the train-side transmitter receiver 73 via the ground-side transmitter receiver 74. However, in the case where the train-side transmitter receiver 73 does not receive the confirmation signal 76d, the train driver or the conductor tells this fact to a station employee. The conductor or the station employee operates a door body opening/closing controller equipped on the platform 80 to send an opening signal for the door bodies 7 to the individual control panel 75 manually.

After passengers have gotten on and off, the train doors are closed. When train departure signal is confirmed, this signal is sent from the train-side transmitter receiver 73 to the integrated control panel 72 via the ground-side transmitter receiver 74. The integrated control panel 72 sends a signal for closing all of the door bodies 7 to the individual control panel 75, and then the door bodies 7 are closed. Next, the departure signal is sent from the integrated control panel 72 to the operation direction center 70 via the station monitor panel 71, and the departure signal is sent from the operation direction center 70 to the station monitor panel 71 at the adjacent station U. The same operation is repeated at each station at which the train arrives.

[0031]

However, depending on the train, the number of cars forming that train is different, or the number of doors of the car of the train is different. In such a case, it is necessary to open and close the door bodies 7a, 7b corresponding to the number of cars and the



number of doors of each car of the train arriving at the platform 80. Next, the opening/closing processing is explained with reference to Figures 21 to 23.

For a train 51, the door position of each car of the train 51 is recognized, and the slide amounts of the door bodies 7a, 7b of the platform door 1 for each composition of the train 51 are formed into a pattern. The chart in Figure 22 shows an example in which some compositions 1 to 4 of the train 51 are formed into a pattern. In pattern 1, the slide amount by which the door bodies 7a, 7b are to be moved is calculated from the door 52 position of composition 1 of the train 51. A, B, C and D indicate the slide amount of one door body; A is the slide amount of the door body 7a, B is that of the door body 7b, C and D are the slide amounts of the adjacent door bodies 7a and 7b. Although being omitted in the chart, the slide amounts of the further adjacent door bodies 7a and 7b are calculated in advance.

[0032]

The numeral value in the chart times 100 (unit: mm) is the slide amount of the door body 7a, 7b. Pattern 2 shows the slide amount of composition 2 of the train 51, and patterns 3 and 4 show the slide amounts of compositions 3 and 4 of the train. In the case where the composition (door position is the same) of each car of the train 51 is the same, the same pattern is applied, and in the case where the number of composition types of the train 51 is five or more, the number of patterns increases further.

In the case where the train is separated midway between the station the train starts from and the terminal station, the pattern is changed at the time of separation. The formed pattern data is stored in the integrated control panel in advance. Instead of the configuration in which all composition patterns 1 to 4 of the train 51 are not stored, a ROM etc. storing the pattern data inherent in that train may be contained in the transmitter so that the formed pattern data is transmitted. The ROM may be replaced for

each composition of train.

[0033]

As a method for telling the pattern of the train arriving at the platform to the station side, some methods are available. Herein, a method for telling in a wireless mode is explained. Figure 23 is a flowchart for this method. All of composition patterns 1 to 4 of train are stored in the train-side transmitter and receiver 73 provided on the train so that the pattern inherent in that train can be recognized. The configuration is made such that the pattern data sent from the ground-side transmitter receiver 74 in a wireless mode can be received on the platform side. The ground-side transmitter receiver 74 sends the pattern data to the integrated control panel 72. In the integrated control panel 72, the pattern data is identified. The identified inherent pattern signal is sent from the integrated control panel 72 to the individual control panels 75a and 75b of the platform door 1.

[0034]

For example, in the case where the composition of the train 51 is pattern 2, for example, the slide amount of the door body 7a of the forefront platform door 1a is 1,000 mm, the slide amount of the door body 7b is 0 mm (not moved), the slide amount of the door body 7a of the adjacent platform door 1b is 0 mm, and the slide amount of the door body 7b thereof is 1,000 mm (explanation of the rear platform door 1c and the subsequent are omitted). The slide amount described here is a slide amount from a state in which the door body 7a, 7b on the platform 80 is fully closed.

After the train 51 has stopped at the platform 80, in synchronization with the timing of door opening of the train 51, the individual control panels 75a and 75b drive the drive motors 35 for the platform door 1 so that the door bodies 7a, 7b to be slid are slid to open the door.

[0035]

The configuration is made such that in the case where the composition of the train 51 is changed, the pattern can be changed appropriately in accordance with the car composition by using a changeover switch.

Also, although the inherent train composition pattern 1 to 4 is told to the station side in a wireless mode in the above-described embodiments, the pattern can be told to the station side in a manual mode. For example, the configuration may be such that the composition pattern of that train is displayed on a display board, and on the platform side, a control panel connected to the integrated control panel 72 is disposed, and the station employee recognizes the pattern of that train and sends it from the control panel at the station to the integrated control panel 72.

Thus, the platform door 1 in accordance with the present invention opens and closes the door bodies 7a and 7b by the control using the control unit, by which the burden on the station employee can be alleviated.

[0036]

Next, a case where the train 51 having different compositions, which is actually being run, arrives at the platform is explained.

Figure 20(a) shows the case where no train is standing at the platform 80. Figures 20(b) to 20(d) show examples in which the platform door 1 is applied to the cases where a train having many different door positions arrives at the same platform 80. Figure 20(a) shows a state in which the platform door 1 is provided along the end edge portion 3 of the platform 80, and all of the platform doors are closed. The passengers wait in this state until a train arrives and stops at the platform 80.

The door pocket 5 has a minimum width, and both ends of the door body 7a, 7b project from the door pocket 5 in the above-described embodiments. However, like the

door pockets 5 of the platform doors 1a, 1b, 1e and 1f, the transverse width may have a margin (play portion). In the case where the door pocket 5 is arranged in this manner, the door pocket 5 may be used so that depending on the opening/closing situation of the door body 7a, 7b, one end side of the door body 7a, 7b is housed in the door pocket 5, and only the other end side thereof is projected from the opening of the door pocket 5.

The indicators 53 have only to be arranged between the door pockets 5 of the platform door 1. This is because the position of the door pocket 5 does not coincide with the boarding-alighting port. As shown in Figure 20(b), in the case where a train having four doors per one car comes, only a portion (hatched portion) of the indicator 53a shown in Figure 20(b) is lighted in the state in which the door bodies 7a, 7b are closed, and a portion (outline portion) indicated by the indicator 53b is not lighted. Thereby, the passengers can judge where they should stand in rows.

[0037]

When the door body 7 is opened corresponding to the boarding-alighting port 52 of the train 51 having four doors per one car as shown in Figure 20(b), as described above, the pattern information including the door position etc. of the train 51, which has been input beforehand, is processed by the control unit 21 provided on the platform or in the door pocket 5 by wireless direction of the train driver (or conductor) of the train 51 or manual operation of a station employee so that the opening portion coincides with the position of the boarding-alighting port of the train 51. That is to say, the door bodies 7a and 7b of only the platform door 1 facing to the boarding-alighting port of the train 51 are opened or slid through a necessary length, by which a passage for the passengers to get on and off can be secured.

Figure 20(c) shows a case where the platform door 1 responds to the train 51 having three doors per one car. For example, for the four-door train, the platform doors

1c and 1d block the platform 80 by sliding the door bodies 7a and 7b to the inside as shown in Figure 20(b). For this three-door train, however, the door bodies 7a and 7b are slid to the outside to open the portion of the boarding-alighting port. Thus, the passengers can get on the train as indicated by the arrow mark.

[0038]

Figure 20(d) shows an example in which the platform door 1 is operated so as to correspond to the train 51 having two doors per one car. For the two-door train, of the door bodies 7a and 7b of the platform doors 1c and 1d, one door body 7a is slid to the inside, and the other door body 7b is slid to the outside, so that the platform 80 is blocked by the platform doors 1c and 1d.

In any case, the door bodies 7a and 7b of the platform door 1 are slid independently, and hence can be opened and closed so as to correspond to the boarding-alighting port of each type of the train 51. Also, the platform where the boarding-alighting port is absent is blocked by the door pocket and the door body. Therefore, the passengers can get on and off the train smoothly while the safety of passengers is secured. It is to be noted that in Figures 20(c) and 20(d), the indicators 53 are omitted.

[0039]

The above is an explanation of the embodiments of the present invention. It is a matter of course that the present invention is not limited to the above-described embodiments, and various modifications and changes can be made based on the technical concept of the present invention.

For example, the door bodies 7a and 7b are supported by one door pocket 5 in the above-described embodiments. However, the door bodies 7a and 7b may be supported by two door pockets 5. In this case, the width of the door body 7a, 7b is made greater than the outside width of the two door pockets 5. Also, although the door bodies 7a and

7b are disposed at the front and rear, the door body may be divided into two above and below in the door pocket 5.

Also, the arrangement may be such that the platform door 1 of the above-described embodiments is combined appropriately with another fixed fence, and the platform door 1 is disposed between the fixed fences (or inversely, the fixed fence is disposed between the platform doors 1).

Although the indicators 53 are embedded in the platform 80 in the above-described embodiments, the indicators 53 can be mounted above the platform or on the door body 7a, 7b. In Figures 20(a) to 20(d), only the movable fences are provided; however, the movable fences and the fixed fences may be provided in combination. That is to say, the fixed fence may be arranged between the platform doors. For example, if the fixed fence is arranged in the coupling portion between the cars, the cost can be reduced.

#### INDUSTRIAL APPLICABILITY

[0040]

If the present invention is applied, in addition to the platform for train, to a bus stop or a gateway of a facility such as a stadium to which people rush, the opening of the gateway can be adjusted. The present invention can widely applied industrially as a movable fence other than that for a platform door.